

Amendments to the Claims:

The following listing of claims replaces all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method of generating plasma in a toroidal plasma generator, said toroidal plasma generator comprising a gas passage having a gas entrance and a gas outlet, said gas passage forming a circuitous path, and a coil wound around a part of the gas passage,

~~characterized in that~~ wherein said method comprises the steps of supplying a mixed gas of an Ar gas and an NF₃ gas containing at least 5% of said NF₃ gas in terms of flow rate, ~~[[and]]~~ igniting plasma by driving said coil with a high-frequency power, and increasing, after said step of igniting plasma, a total pressure of said mixed gas,

said step of igniting plasma being conducted under a total pressure of 6.65-66.5Pa.

2. (Currently Amended) The method of generating plasma as claimed in claim 1, ~~characterized in that~~ wherein said mixed gas contains NF₃ by a concentration of 5% or more but not exceeding 45% in terms of flow rate in said plasma ignition step.

3. (Currently Amended) The method of generating plasma as claimed in claim 1, ~~characterized in that~~ wherein said mixed gas in said plasma ignition step contains NF₃ with a concentration of 10% or more but not exceeding 45% in terms of flow rate in said plasma ignition step.

4. (Currently Amended) The method of generating plasma as claimed in claim 1, ~~characterized in that~~ wherein said mixed gas contains NF₃ with a

concentration of 20% or more but not exceeding 45% in terms of flow rate in said plasma ignition step.

5. (Canceled)

6. (Currently Amended) The method of generating plasma as claimed in claim 5, ~~characterized in that~~ wherein said step of increasing said total pressure of said mixed gas is conducted while maintaining said concentration of NF_3 in said mixed gas at constant.

7. (Currently Amended) The method of generating plasma as claimed in claim 5, ~~characterized in that~~ wherein said step of increasing the total pressure of said mixed gas is conducted while changing said concentration of NF_3 in said mixed gas.

8. (Currently Amended) The method of generating plasma as claimed in claim 5, ~~characterized in that~~ wherein said mixed gas contains NF_3 , after said step of increasing said total pressure of said mixed gas, with a concentration of 5 – 40% in terms of flow rate.

9. (Currently Amended) The method of generating plasma as claimed in claim 1, ~~characterized in that~~ wherein said mixed gas is supplied with a flow rate of 100SCCM or less in said plasma ignition step.

10. (Currently Amended) The method of generating plasma as claimed in claim 1, ~~characterized in that~~ wherein said mixed gas is supplied with a flow rate of 3SCCM or more but not exceeding 80SCCM.

11. (Currently Amended) A method of generating plasma in a toroidal plasma generator, said toroidal plasma generator comprising a gas

passage having a gas entrance and a gas outlet, said gas passage forming a circuitous path, and a coil ~~would~~ wound around a part of said gas passage,

~~characterized in that~~ wherein said method comprises the steps of supplying a mixed gas of an Ar gas and a F₂ gas containing at least 5% of said F₂ gas in terms of flow rate, ~~[[and]]~~ igniting plasma by driving said coil with a high-frequency power, and increasing, after said ignition step, a total pressure of said mixed gas,

said step of igniting plasma being conducted under a total pressure of 6.65-66.5Pa.

12. (Currently Amended) The method of generating plasma as claimed in claim 11, ~~characterized in that~~ wherein said mixed gas contains F₂ with a concentration of 5% or more but not exceeding 45% in terms of flow rate.

13. (Canceled)

14. (Currently Amended) The method of generating plasma as claimed in claim 13, ~~characterized in that~~ wherein said step of increasing said total pressure of said mixed gas is conducted while maintaining said concentration of F₂ in said mixed gas at constant.

15. (Currently Amended) The method of generating plasma as claimed in claim 13, ~~characterized in that~~ wherein said step of increasing said total pressure of said mixed gas is conducted while changing said concentration of F₂ in said mixed gas.

16. (Currently Amended) The method of generating plasma as claimed in claim 11, ~~characterized in that~~ wherein said mixed gas is supplied with a flow rate of 100SCCM or less in said plasma ignition step.

17. (Currently Amended) A cleaning method for cleaning a processing vessel evacuated by an evacuating system and coupled with a remote plasma source,

said remote plasma source comprising a toroidal plasma generator, said toroidal plasma generator comprising a gas passage having a gas entrance and a gas outlet, said gas passage forming a circuitous path, and a coil ~~would~~ wound around a part of said gas passage,

~~characterized in that~~ wherein said cleaning method comprises the steps of:

forming radicals containing F in said remote plasma source; and
supplying said radicals to an interior of said processing vessel and
cleaning said interior of said processing vessel by said radicals,

said step of forming said radicals comprising the steps of:

supplying a mixed gas containing at least 5% of NF_3 or F_2 in terms of flow rate in an Ar gas to said gas passage as a cleaning gas with a first pressure in which plasma can ignite and igniting plasma by driving said coil by a high-frequency power; and

increasing, after ignition of said plasma, a total pressure of said mixed gas in said gas passage to a second pressure while maintaining said plasma,

said cleaning step cleaning said interior of said processing vessel at said second pressure.

18. (Currently Amended) The cleaning method as claimed in claim 17, ~~characterized in that~~ wherein said step of increasing said total pressure of said mixed gas comprises a step of changing a conductance of said evacuation system and a step of changing a flow rate of said mixed gas.

19. (Currently Amended) The cleaning method as claimed in claim 17, ~~characterized in that~~ wherein said step of changing said total pressure of said

mixed gas is conducted by changing a conductance of said evacuation system and a flow rate of said mixed gas simultaneously.

20. (Currently Amended) The cleaning method as claimed in claim 17, ~~characterized in that~~ wherein said step of changing said total pressure of said mixed gas comprises a step of decreasing a conductance of said evacuation system while maintaining a flow rate of said mixed gas constant, and a step of increasing said flow rate of said mixed gas while maintaining said total pressure constant.

21. (Currently Amended) The cleaning method as claimed in claim 20, ~~characterized in that~~ wherein said method further comprises a step of increasing said flow rate of said mixed gas while holding said conductance of said evacuation system maximum.

22. (Currently Amended) The cleaning method as claimed in claim 17, ~~characterized in that~~ wherein said step of changing said total pressure of said mixed gas comprises a step of switching plural mass flow controllers.

23. (Currently Amended) The cleaning method as claimed in claim 17, ~~characterized in that~~ wherein said step of increasing said total pressure of said mixed gas is conducted while maintaining said concentration of said cleaning gas in said mixed gas constant.

24. (Currently Amended) The cleaning method as claimed in claim 17, ~~characterized in that~~ wherein said step of increasing said total pressure of said mixed gas is conducted while changing said concentration of said cleaning gas in said mixed gas.

25. (Currently Amended) The cleaning method as claimed in claim 17, ~~characterized in that~~ wherein said cleaning step is conducted by setting said concentration of NF_3 in said mixed gas to 50-40% in terms of flow rate.

26. (Currently Amended) The cleaning method as claimed in claim 17, ~~characterized in that~~ wherein said mixed gas is supplied with a flow rate of 100SCCM or less in said plasma ignition step.

27. (Currently Amended) The cleaning method as claimed in claim 17, ~~characterized in that~~ wherein said mixed gas contains NF_3 as said cleaning gas and wherein said first pressure is set to 6.65-66.5Pa.

28. (Currently Amended) The cleaning method as claimed in claim 27, ~~characterized in that~~ wherein said mixed gas contains NF_3 , in said plasma ignition step, as said cleaning gas with a concentration of 5% or more but not exceeding 45% in terms of flow rate.

29. (Currently Amended) The cleaning method as claimed in claim 27, ~~characterized in that~~ wherein said mixed gas contains NF_3 , in said plasma ignition step, as said cleaning gas with a concentration of 10% or more but not exceeding 45% in terms of flow rate.

30. (Currently Amended) The cleaning method as claimed in claim m 27, ~~characterized in that~~ wherein said mixed gas contains NF_3 , in said plasma ignition step, with a concentration of 20% or more but note exceeding 45% in terms of flow rate.

31. (Currently Amended) The cleaning method as claimed in claim 17, ~~characterized in that~~ wherein said mixed gas contains F_2 as said cleaning gas, and wherein said first pressure is set to 6.65 - 66.5Pa.

32. (Currently Amended) The cleaning method as claimed in claim 31, wherein said mixed gas contains F_2 , in said plasma ignition step, as said cleaning gas with a concentration of 5% or more but not exceeding 45% in terms of flow rate.

33. (Currently Amended) A substrate processing method in a processing vessel evacuated by an evacuation system and coupled with a remote plasma source,

~~characterized in that~~ wherein said remote plasma source comprises a toroidal plasma generator comprising a gas passage having a gas entrance and a gas outlet and forming a circuitous path, and a coil ~~would~~ wound around a part of said gas passage,

said substrate processing method comprising the steps of:
forming radicals containing F in said remote plasma source; and
etching a surface of a substrate to be processed in said processing vessel by said radicals by supplying said radicals to an interior of said processing vessel,

said step of forming said radicals comprising the steps of:
supplying a mixed gas containing NF_3 or F_2 in an Ar gas with a concentration of at least 5% in terms of flow rate to said gas passage under a first pressure in which ignition of plasma is possible and igniting plasma by driving said coil with a high-frequency power; and

increasing, after ignition of said plasma, a total pressure of said mixed gas in said passage to a second pressure while maintaining said plasma, said step of etching being conducted under said second pressure.

34. (Currently Amended) The substrate processing method as claimed in claim 33, ~~characterized in that~~ wherein said step of increasing said

total pressure of said mixed gas comprises a step of changing a conductance of said evacuation system and a step of changing a flow rate of said mixed gas.

35. (Original) The substrate processing method as claimed in claim 33, wherein said step of changing said total pressure of said mixed gas is conducted by changing a conductance of said evacuating system and a flow rate of said mixed gas simultaneously.

36. (Currently Amended) The substrate processing method as claimed in claim 33, ~~characterized in that~~ wherein said step of changing said total pressure of said mixed gas comprises a step of decreasing a conductance of said evacuation system while maintaining a flow rate of said mixed gas constant, and a step of increasing said flow rate of said mixed gas while maintaining said total pressure constant.

37. (Currently Amended) The substrate processing method as claimed in claim 36, ~~characterized in that~~ wherein said method further comprises a step of increasing said flow rate of said mixed gas while holding said conductance of said evacuation system maximum.

38. (Currently Amended) The substrate processing method as claimed in claim 33, ~~characterized in that~~ wherein said step of changing said total pressure of said mixed gas comprises the step of switching plural mass flow controllers.

39. (Currently Amended) The substrate processing method as claimed in claim 33, ~~characterized in that~~ wherein said step of increasing said total pressure of said mixed gas is conducted while maintaining said concentration of said etching gas in said mixed gas constant.

40. (Currently Amended) The substrate processing method as claimed in claim 33, ~~characterized in that~~ wherein said step of increasing said total pressure of said mixed gas is conducted while changing said concentration of said etching gas in said mixed gas.

41. (Currently Amended) The substrate processing method as claimed in claim 33, ~~characterized in that~~ wherein said etching step is conducted by setting said concentration of NF_3 in said mixed gas to 50-40% in terms of flow rate.

42. (Currently Amended) The substrate processing method as claimed in claim 33, ~~characterized in that~~ wherein said mixed gas is supplied in said plasma ignition step with a flow rate of 100SCCM or less.

43. (Currently Amended) The substrate processing method as claimed in claim 33, ~~characterized in that~~ wherein said mixed gas contains NF_3 as said etching gas, and wherein said first pressure is set to 6.65 - 66.5Pa.

44. (Currently Amended) The substrate processing method as claimed in claim 43, ~~characterized in that~~ wherein said mixed gas contains NF_3 in said plasma ignition step as said etching gas with a concentration of 5% or more but not exceeding 45% in terms of flow rate.

45. (Currently Amended) The substrate processing method as claimed in claim 43, ~~characterized in that~~ wherein said mixed gas contains NF_3 as said etching gas in said plasma ignition step with a concentration of 10% or more but not exceeding 45% in terms of flow rate.

46. (Currently Amended) The substrate processing method as claimed in claim 43, ~~characterized in that~~ wherein said mixed gas contains NF_3 as said etching gas in said plasma ignition step with a concentration of 20% or more but not exceeding 45% in terms of flow rate.

47. (Currently Amended) The substrate processing method as claimed in claim 33, ~~characterized in that~~ wherein said mixed gas contains F_2 as said etching gas and wherein said first pressure is set to 6.65 - 66.5Pa.

48. (Currently Amended) The substrate processing method as claimed in claim 47, ~~characterized in that~~ wherein said mixed gas contains F_2 as said etching gas in said plasma ignition step with a concentration of 5% or more but not exceeding 45% in terms of flow rate.

49. (Currently Amended) A cleaning method for cleaning an interior of a processing vessel by plasma-excited radicals of a cleaning gas under a first pressure zone, ~~characterized in that~~ said method ~~comprises~~ comprising the steps of:

introducing a mixed gas of a diluting gas and a cleaning gas to a plasma generator under a second pressure lower than said first pressure and igniting plasma; and

increasing, after ignition of said plasma, a pressure inside said processing vessel to said first pressure zone from said second pressure zone.

50. (Currently Amended) The cleaning method as claimed in claim 49, ~~characterized in that~~ wherein said cleaning gas contains a halogen compound.

51. (Currently Amended) The cleaning method as claimed in claim 49, ~~characterized in that~~ wherein said cleaning gas contains NF_3 .

52. (Currently Amended) The cleaning method as claimed in claim 49, ~~characterized in that~~ wherein said cleaning gas contains F₂.

53. (Currently Amended) The cleaning method as claimed in claim 49, ~~characterized in that~~ wherein said diluting gas is selected from ~~any of the~~ group consisting of Ar, Kr and Xe.

54. (Currently Amended) The cleaning method as claimed in claim 49, ~~characterized in that~~ wherein said plasma generator is a toroidal plasma generator.

55. (Currently Amended) The cleaning method as claimed in claim 49, ~~characterized in that~~ wherein said plasma generator is ~~any one~~ selected from the group consisting of a capacitive-coupled plasma generator, an induction-coupled plasma generator, an ECR plasma generator, a helicon wave plasma generator, and a microwave cavity plasma generator.

56. (Currently Amended) A substrate processing method for etching a surface of a substrate to be processed by plasma-excited radicals under a first pressure zone, comprising the steps of:

introducing a mixed gas of a diluting gas and an etching gas into a plasma generator under a second pressure lower than said first pressure and igniting plasma; and

increasing, after ignition of said plasma, a pressure inside said processing vessel to said first pressure zone from said second pressure zone.

57. (Currently Amended) The substrate processing method as claimed in claim 56, ~~characterized in that~~ wherein said etching gas contains a halogen compound.

58. (Currently Amended) The substrate processing method as claimed in claim 56, ~~characterized in that~~ wherein said etching gas contains NF_3 .

59. (Currently Amended) The substrate processing method as claimed in claim 56, ~~characterized in that~~ wherein said etching gas contains F_2 .

60. (Currently Amended) The substrate processing method as claimed in claim 56, ~~characterized in that~~ wherein said diluting gas is selected from ~~any of the group consisting of~~ Ar, Kr and Xe.

61. (Currently Amended) The substrate processing method as claimed in claim 56, ~~characterized in that~~ wherein said plasma generator is a toroidal type plasma generator.

62. (Currently Amended) The substrate processing method as claimed in claim 56, ~~characterized in that~~ wherein said plasma generator is ~~any one~~ selected from the group consisting of a capacitive-coupled plasma generator, an induction-coupled plasma generator, an ECR plasma generator, a helicon wave plasma generator, and a microwave cavity plasma generator.

63. (Currently Amended) A cleaning method for cleaning an interior of a processing vessel by plasma-excited radicals of a cleaning gas ~~under~~ with a first ~~pressure~~ flow rate zone, comprising the steps of:

introducing a mixed gas of a diluting gas and a cleaning gas into a plasma generator under a second flow rate zone smaller than said first flow rate zone and igniting plasma; and

increasing, after ignition of said plasma, a flow rate of said mixed gas from said first flow rate zone to said second flow rate zone.

64. (Currently Amended) The cleaning method as claimed in claim 63, ~~characterized in that~~ wherein said cleaning gas contains a halogen compound.

65. (Currently Amended) The cleaning method as claimed in claim 63, ~~characterized in that~~ wherein said cleaning gas contains NF_3 .

66. (Currently Amended) The cleaning method as claimed in claim 63, ~~characterized in that~~ wherein said cleaning gas contains F_2 .

67. (Currently Amended) The cleaning method as claimed in claim 63, ~~characterized in that~~ wherein said diluting gas is selected from ~~any of the~~ group consisting of Ar, Kr and Xe.

68. (Currently Amended) The cleaning method as claimed in claim 63, ~~characterized in that~~ wherein said plasma generator is a toroidal plasma generator.

69. (Currently Amended) The cleaning method as claimed in claim 63, ~~characterized in that~~ wherein said plasma generator is ~~any one~~ selected from the group consisting of a capacitive-coupled plasma generator, an induction-coupled plasma generator, an ECR plasma generator, a helicon wave plasma generator, and a microwave cavity plasma generator.

70. (Currently Amended) A substrate processing method for etching a surface of a substrate to be processed in a processing vessel by plasma-excited radicals of etching under a first flow rate zone, comprising the steps of:

introducing a mixed gas of a diluting gas and an etching gas into a plasma generator under a second flow rate zone smaller than said first flow rate zone and igniting plasma; and

increasing, after ignition of said plasma, a flow rate of said mixed gas from said second flow rate zone to said first flow rate zone.

71. (Currently Amended) The substrate processing method as claimed in claim 70, ~~characterized in that~~ wherein said cleaning gas contains a halogen compound.

72. (Currently Amended) The substrate processing method as claimed in claim 70, ~~characterized in that~~ wherein said cleaning gas contains NF_3 .

73. (Currently Amended) The substrate processing method as claimed in claim 70, ~~characterized in that~~ wherein said cleaning gas contains F_2 .

74. (Currently Amended) The substrate processing method as claimed in claim 70, ~~characterized in that~~ wherein said diluting gas is selected from ~~any of the group consisting of~~ Ar, Kr and Xe.

75. (Currently Amended) The substrate processing method as claimed in claim 70, ~~characterized in that~~ wherein said plasma generator is a toroidal plasma generator.

76. (Currently Amended) The substrate processing method as claimed in claim 70, ~~characterized in that~~ wherein said plasma generator is ~~any one~~ selected from the group consisting of a capacitive-coupled plasma generator, an induction-coupled plasma generator, an ECR plasma generator, a helicon wave plasma generator, and a microwave cavity plasma generator.

77. (New) A method of generating plasma in a toroidal plasma generator, said toroidal plasma generator comprising a gas passage having a gas

entrance and a gas outlet, said gas passage forming a circuitous path, and a coil would around a part of the gas passage,

wherein said method comprises the steps of supplying a mixed gas of an Ar gas and an NF_3 gas containing at least 5% of said NF_3 gas in terms of flow rate, igniting plasma by driving said coil with a high-frequency power, and increasing, after said step of igniting plasma, a concentration of said NF_3 gas in said mixed gas,

said step of igniting plasma being conducted under a total pressure of 6.65-66.5Pa.

78. (New) A method of generating plasma in a toroidal plasma generator, said toroidal plasma generator comprising a gas passage having a gas entrance and a gas outlet, said gas passage forming a circuitous path, and a coil would around a part of the gas passage,

wherein said method comprises the steps of supplying a mixed gas of an Ar gas and an F_2 gas containing at least 5% of said F_2 gas in terms of flow rate, igniting plasma by driving said coil with a high-frequency power, and increasing, after said ignition step, a concentration of said F_2 gas in said mixed gas,

said step of igniting plasma being conducted under a total pressure of 6.65-66.5Pa.

79. (New) A cleaning method for cleaning a processing vessel evacuated by an evacuating system and coupled with a remote plasma source,

said remote plasma source comprising a toroidal plasma generator, said toroidal plasma generator comprising a gas passage having a gas entrance and a gas outlet, said gas passage forming a circuitous path, and a coil wound around a part of said gas passage,

wherein said cleaning method comprises the steps of:

forming radicals containing F in said remote plasma source; and

supplying said radicals to an interior of said processing vessel and cleaning said interior of said processing vessel by said radicals,
said step of forming said radicals comprising the steps of:
supplying a mixed gas containing at least 5% of NF_3 or F_2 in terms of flow rate in an Ar gas to said gas passage as a cleaning gas with a first pressure in which plasma can ignite and igniting plasma by driving said coil by a high-frequency power; and
increasing, after ignition of said plasma, a concentration of NF_3 or F_2 in said mixed gas in said gas passage to a second pressure while maintaining said plasma,
said cleaning step cleaning said interior of said processing vessel at said second pressure.

80. (New) A substrate processing method in a processing vessel evacuated by an evacuation system and coupled with a remote plasma source, wherein said remote plasma source comprises a toroidal plasma generator comprising a gas passage having a gas entrance and a gas outlet and forming a circuitous path, and a coil wound around a part of said gas passage
said substrate processing method comprising the steps of:
forming radicals containing F in said remote plasma source; and
etching a surface of a substrate to be processed in said processing vessel by said radicals by supplying said radicals to an interior of said processing vessel,
said step of forming said radicals comprising the steps of:
supplying a mixed gas containing NF_3 or F_2 in an Ar gas with a concentration of at least 5% in terms of flow rate to said gas passage under a first pressure in which ignition of plasma is possible and igniting plasma by driving said coil with a high-frequency power; and

increasing, after ignition of said plasma, a concentration of NF_3 or F_2 in said mixed gas in said passage to a second pressure while maintaining said plasma,

said step of etching being conducted under said second pressure.

81. (New) A cleaning method for cleaning an interior of a processing vessel by plasma-excited radicals of a cleaning gas of a first concentration, said method comprising the steps of:

introducing a mixed gas of a diluting gas and a cleaning gas to a plasma generator with a second concentration lower than said first concentration and igniting plasma; and

increasing, after ignition of said plasma, a concentration of said radicals in said processing vessel to said first concentration from said second concentration.

82. (New) A substrate processing method for etching a surface of a substrate to be processed by plasma-excited radicals of a first concentration, comprising the steps of:

introducing a mixed gas of a diluting gas and an etching gas into a plasma generator with a second concentration lower than said first concentration for said etching gas and igniting plasma; and

increasing, after ignition of said plasma, a concentration of said etching gas in said processing vessel to said first concentration from said second concentration.